REMARKS

Claim 29 has been amended and claims 33-50 have been added to claim subject matter similar to that claimed in the corresponding Japanese application. Claim 29 has been amended to recite a green light-emitting material which is an orthometallated complex similar to, e.g., claims 10 and 16 in the Amendment filed November 22, 2002, and to recite wavelength ranges like those recited in, e.g., claim 10 in the November 22, 2002 Amendment. The claims are supported by the disclosure at, e.g., page 4, line 22 to page 5, line 19, page 6, lines 8-18, page 8, lines 20-21, and Examples 1-4 in the specification.

Entry of the above amendment is respectfully requested.

Obviousness Rejection

On page 2 of the Office Action, in paragraph 3, claims 29-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Baldo et al. in *Appl. Phys. Lett.* 75(1), pp. 4-6 (July 5, 1999) or Forrest et al. (US 6,310,360 B1), either reference in view of Egusa et al. (US 5,294,810), and further in view of Kido et al. in *Science*, Vol. 267, pp. 1332-1334 (March 1995) or JP 07-142169.

In response, Applicant notes initially that the present claims recite (1) the presence of all of blue, green and red light-emitting materials, and (2) green light-emitting material being an orthometallated complex as essential features of the invention.

Applicant submits that the present invention provides unexpectedly superior results as can be seen from the present specification and the Rule 132 Declaration submitted herewith, as discussed below.

(1) The Declaration includes data obtained by comparing Ir(ppy)3 alone (= not with any blue or red light-emitting material) and coumarin 6 alone (= not with any blue or red light-emitting material). The former shows a maximum luminance which is higher than that of the latter, but which is only about 1.4 times higher.

(2) However, the device containing blue and red light-emitting materials, too, showed a maximum luminance which was about 10 times higher when it contained an orthometallated complex (Ir(ppy)3) as a green light-emitting material, than when it contained a non-orthometallated complex (coumarin 6), as can be seen in the Examples in the present specification.

(3) Applicant presumes that when an orthometallated complex is used as a green light-emitting material, a transfer of energy may occur from the green light-emitting material to the red, since the orthometallated complex has a long exciton lifetime.

(4) According to an important feature of the present invention, such a transfer of energy to the red light-emitting material raises the efficiency of red light emission and thereby makes it possible to obtain an excellent white light emission of high luminance. Applicants submit that one of ordinary skill in the art at the time of the present invention would not have expected such an outstanding result.

Applicant submits that the known light-emitting devices have still been unsatisfactory in light-emitting efficiency and luminance, and it has been difficult to produce a white light-emitting device showing an excellent light-emitting efficiency and light-emitting luminance, as can be seen from the "Background of the Invention" section of the present application. Thus, as indicated in the "Summary of the Invention" section of the present application, it is an object of the present invention to provide a light-emitting device which can effectively be utilized as a surface light source for a full color display, a back light or an illumination light source, or as a light source array in a printer and which shows an excellent light-emitting efficiency and light-emitting luminance, and it is also an object of the present invention to provide a white light-emitting device showing an excellent light- emitting efficiency and light-emitting luminance.

The present invention achieves the above objects by providing a light-emitting device containing a blue light-emitting material having a light-emitting wavelength peak of 400 to 500 nm, a green light-emitting material having a light-emitting wavelength peak of 500 to 570 nm and a red light-emitting material having a light-emitting wavelength peak of 580 to 670 nm in its light-emitting layer, wherein the green light-emitting material comprises at least one green light-emitting material which is an orthometallated complex.

In this regard, Applicant will now present comparative data and explain the advantages of the claimed light-emitting device which can be obtained from its features stated above.

<Comparative Data>

As set forth in the Rule 132 Declaration submitted herewith, light-emitting devices (1) and (2) were prepared having the features as stated below according to Additional Comparative

Examples 1 and 2, respectively, and otherwise having the features of the device according to Example 1 in the specification. The devices were evaluated in accordance with the explanation set forth in connection with Example 1. The results are shown in Table 2 below.

(1) Additional Comparative Example 1:

Polyvinyl carbazole / tris(2-phenylpyridine)iridium complex (an orthometallated complex as a green light-emitting material) / 2-(4-biphenyl)-5-(4-t-butylphenyl)-1,3,4-oxadiazole (electron transporting material) = 200 / 6 / 50 (by weight);

(2) Additional Comparative Example 2:

Polyvinyl carbazole / coumarin 6 (a green light-emitting material) / 2-(4-biphenyl)-5-(4-t-butylphenyl)-1,3,4-oxadiazole (electron transporting material) = 200 / 6 / 50 (by weight).

[Table 2]

	Lmax (Cd/m^2)	Vmax (V)	P (Cd/A)	Light-emitting wavelength peak (nm)
Additional Comparative Example 1	32000	11	25	515
Additional Comparative Example 2	23000	15	1.8	520

Both of the devices (1) and (2) according to Additional Comparative Examples 1 and 2 contained only a green light-emitting material as their light-emitting material. In other words, the devices were compared in performance by the green light-emitting materials which they contain. While the device (2) containing coumarin 6 as its green light-emitting material showed a maximum luminance Lmax of 23,000, the device (1) containing an orthometallated complex as

its green light-emitting material showed a maximum luminance Lmax of 32,000, which is higher than that of the device (2), but only about 1.4 times higher.

According to the Examples in the specification, the devices of Examples 1 to 4 each containing a blue, a green and a red light-emitting material in its light-emitting layer and employing an orthometallated complex as its green light-emitting material were evaluated with the devices of Comparative Examples 1 and 2 each containing a blue, a green and a red light-emitting material in its light-emitting layer and employing coumarin 6 as its green light-emitting material. Accordingly, the devices containing a blue and a red light-emitting material as well as a green light-emitting material were compared. While the device of Comparative Example 1 employing coumarin 6 as its green light-emitting material showed a maximum luminance Lmax of only 2,400, the device of Example 1 employing an orthometallated complex as its green light-emitting material showed a maximum luminance Lmax of 23,000, which is as much as about 10 times higher than that of the device of Comparative Example 1. Each of the devices according to Examples 1 and 2 and Comparative Example 1 contained a mixture of green, blue and red light-emitting material in a single layer, while each of the devices according to Examples 3 and 4 and Comparative Example 2 contained green, blue and red light-emitting material in different layers, respectively. While the device of Comparative Example 2 employing coumarin 6 as its green light-emitting material showed a maximum luminance Lmax of only 5,200, the device of Example 3 employing an orthometallated complex as its green light-emitting material showed a maximum luminance Lmax of 56,000, which is as much as about 10 times higher than that of the device of Comparative Example 2.

Thus, the device containing an orthometallated complex as its green light-emitting material, as well as containing a blue and a red light-emitting material, exhibited a drastically improved luminance owing to the orthometallated complex. As a consequence, it provided a white light-emitting device realizing an excellent maximum luminance.

The outstanding advantages of the device as claimed presumably owe themselves to a mechanism which will now be stated.

<Presumed Mechanism>

When an orthometallated complex is used as a green light-emitting material, its relatively long exciton lifetime (~ μsec) causes the transfer of energy from the exciton of the green light-emitting material to the red light-emitting material to occur and enables the red light-emitting material to emit light efficiently. However, when the green light-emitting material is not an orthometallated complex, it has a relatively short exciton lifetime (~ nsec), and even if the green and red light-emitting materials may be contained in a single layer, or in separate, but adjacent layers, it is difficult to obtain the transfer of energy from the exciton of the green light-emitting material to the red light-emitting material and utilize the intense emission of the green light-emitting material satisfactorily for the emission of a red light.

The invention as claimed is essentially featured by employing an orthometallated complex as a green light-emitting material to cause the transfer of energy to the red light-emitting material and raise the efficiency of emission of a red light to thereby realize the emission of an excellent white light of high luminance, as explained above.

The Declarant submits that it would not have been possible for one of ordinary skill in the art to expect the outstanding results of the present invention as stated above from a light-emitting layer containing a blue, a green and a red light-emitting material and an orthometallated complex as the green light-emitting material when the present application was filed.

Thus, the Declarant concludes that the present invention provides unexpectedly superior results and is not obvious accordingly.

Applicant submits that the cited art does not disclose, suggest, or otherwise render obvious the drastically improved luminance achieved by an orthometallated complex used as a green light-emitting material when a blue light-emitting material and a red light-emitting material are also used together.

Further, Applicant submits that one of ordinary skill in the art at the time of the present invention would not have expected to obtain a device capable of emitting an excellent white light of high luminance from a light-emitting layer containing blue, green and red light-emitting materials, wherein the green light-emitting material comprises at least one green light-emitting material which is an orthometallated complex.

Accordingly, Applicant submits that the present invention is not obvious from the cited art, and withdrawal of this rejection is respectfully requested.

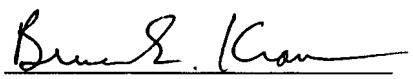
Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the

Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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